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MAY 17 2000

MM Docket No. 00-39

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY
00-39

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No. of Copies rec'd 044
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SUMMARY

The FCC's 8-VSB transmission standard is meeting the performance goals for which it was selected: superior signal coverage of existing NTSC service areas, a high bit-rate capacity and interference rejection. Although some early generation VSB receivers did not provide adequate indoor reception in a relatively small number of urban environments with strong multipath interference, new generations of chips and receivers are demonstrating significant improvement. Zenith is confident that these improvements will continue.

Since the beginning of the DTV movement, the top priority has been insuring that a DTV station's service area is generally equal to or better than its NTSC service area, thereby allowing digital broadcasting to reach the maximum number of viewers possible. The 8-VSB system meets this goal, a fact that is well-documented by studies conducted at literally thousands of field test sites, including a recent scientific study conducted by CBS. Following extensive testing of numerous indoor and outdoor reception sites, the CBS study concluded that "it is evident that the current ATSC system is replicating the NTSC reception coverages for both indoor and outdoor reception" and that "8-VSB remains a viable system for providing DTV service and replication of the broadcasters' service area."

Zenith submits that if broadcasters and consumers now desire other options – such as portable or mobile applications – the VSB technology has the flexibility for future enhancements. Extensions of the ATSC DTV Standard, however, should be pursued in parallel with ongoing 8-VSB receiver improvements so as not to hinder the

transition to free over-the-air digital television. As the Commission has already recognized, a change in the DTV transmission standard to include COFDM technology would inevitably require a multi-year effort, thereby causing a significant and harmful delay in the implementation and provision of DTV services to the public.

Considering the profound public interest benefits to be derived from digital technology, Zenith encourages the Commission to continue exercising commanding leadership over the transition. Such leadership will ensure that the multi-industry commitment to a rapid rollout of digital services continues unimpeded.

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Review of the Commission's)	MM Docket No. 00-39
Rules and Policies)	
Affecting the Conversion)	
to Digital Television)	
)	

**COMMENTS OF
ZENITH ELECTRONICS CORPORATION**

I. INTRODUCTION/OVERVIEW

Zenith Electronics Corporation ("Zenith") hereby submits its comments in response to the Notice of Proposed Rule Making ("NPRM"), released by the Commission on March 8, 2000 in the above-captioned proceeding, concerning the progress of the conversion of our nation's television system from analog technology to digital television ("DTV").¹ In soliciting comments, the FCC is following through on its promise to conduct a periodic review until the cessation of analog television service to ensure a smooth and rapid transition to digital broadcasting.² Although the NPRM

¹ See Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, Notice of Proposed Rule Making, MM Docket No. 00-39, FCC 00-83 (rel. Mar. 8, 2000) ("NPRM").

² See Fifth Report and Order, 12 FCC Rcd 12809, 12856 (1997), on recon., Memorandum Opinion and Order on Reconsideration of the Fifth Report and Order, 13 FCC Rcd 6860, on further recon., Second Memorandum Opinion and Order on

notes that much progress has been made, the Commission nevertheless invites comment on a number of issues that the FCC believes “require resolution to ensure that this progress continues and that potential sources of delay are eliminated.”³

In soliciting general comment on the progress of the transition, the NPRM notes that, among other general issues, concerns have been raised by a certain segment of the broadcast industry with respect to the 8-VSB modulation system recommended by the FCC Advisory Committee on Advanced Television Services (“ACATS”), documented by the Advanced Television Systems Committee (“ATSC”) and unanimously adopted by the Commission as the standard for DTV transmission. Specifically, as the NPRM notes, Sinclair Broadcasting Group has questioned the ability of the 8-VSB system to provide satisfactory “over-the-air” service in urban areas using simple indoor antennas, and has urged the agency to modify the ATSC DTV transmission standard to permit the use of another modulation technique – COFDM – in addition to the 8-VSB standard.⁴

Although the Commission has stated that it continues “to believe that NTSC service replication is achievable by DTV operations using the 8-VSB standard,” the agency

Reconsideration of the Fifth and Sixth Report and Orders, 14 FCC Rcd 1348 (1998), recon. dismissed, DA 99-1361, released July 12, 1999, recon. dismissed, FCC 00-59, released February 23, 2000.

³ NPRM at ¶ 1.

⁴ On February 4, 2000, the Commission unanimously dismissed a Petition for Expedited Rulemaking filed by Sinclair Broadcasting Group which argued for the integration of COFDM technology into the ATSC DTV Standard. The FCC rejected Sinclair’s petition, noting that “Sinclair has done nothing more than to demonstrate a shortcoming of early DTV receiver implementation, rather than a basic flaw in the ATSC standard” and that “granting its request would lead to significant delay in the implementation and provision of DTV services to the public.” Letter to Martin R. Leader, Esq., FCC 00-35 (rel. Feb. 4, 2000) (the “Sinclair Letter”).

nevertheless has invited comment on the current status of the 8-VSB standard and the progress being made to improve indoor reception under the standard.⁵

Zenith respectfully submits that the 8-VSB transmission standard is meeting the performance goals for which it was selected – notably, superior signal coverage of existing NTSC service areas. Zenith also acknowledges that some early VSB receiver implementations did not provide adequate indoor reception to the relatively small number of urban environments with strong multipath interference. Digital television receiver and chip manufacturers, however, are making significant improvements to indoor reception capability in each successive generation of receivers. Accordingly, the Commission should resist any efforts to reopen the transmission standard. Reconsidering the standard would only serve to create confusion and uncertainty, thereby needlessly disrupting the strong momentum that has been building in the DTV marketplace to keep the digital transition charging full speed ahead – a devastating result for the Commission, broadcasters, retailers and, most importantly, the public.

II. ZENITH ELECTRONICS CORPORATION AND THE DEVELOPMENT OF VSB TECHNOLOGY

From the earliest beginnings of digital television, Zenith has been at the vanguard, helping to develop and implement this exciting and important technology in the United States. In 1987, Zenith became a founding member of the FCC's ACATS, and the company began its research on high definition television ("HDTV"). A year

⁵ NPRM at ¶¶ 11-12.

later, Zenith proposed one of the original 23 HDTV systems to the FCC, where Zenith introduced the idea of using “taboo” broadcast channels for simulcasting HDTV.

In 1990, the FCC mandated that the HDTV standard would be based on the “simulcast” approach proposed by Zenith, and the company introduced the vestigial sideband (“VSB”) digital transmission system a year later. Zenith joined the Digital HDTV Grand Alliance, which combined the technologies of four previous digital systems for a “best-of-the-best” HDTV standard for the United States.

In 1994, the Grand Alliance chose Zenith’s VSB technology as its broadcast and cable transmission standard. From 1992 to 1995, the entire DTV system was developed by the Grand Alliance, extensively tested under the auspices of ACATS and documented by the ATSC as the standard for digital broadcasting. In 1995, the ACATS recommended the Commission’s adoption of the ATSC DTV Standard as the standard for digital television broadcasting in the United States. In 1996, the Commission adopted the ATSC DTV Standard (with minor modifications), including Zenith’s VSB technology. Since then, Zenith has continued to advance DTV technology and be a leader in the effort to bring the benefits of digital television to all Americans, including the introduction of advanced HDTV integrated receivers, set-top boxes and displays, which have all been well received in the marketplace.

III. THE DIGITAL CONVERSION IS BUILDING STRONG MOMENTUM

As the Commission notes in the NPRM, the digital conversion is progressing, and most broadcasters are working diligently to convert to DTV, pursuant to the

agency's aggressive construction schedule.⁶ According to the National Association of Broadcasters, more than 125 television stations are currently broadcasting digitally using the 8-VSB standard, covering approximately 63 percent of the nation's television households. According to the Consumer Electronics Association ("CEA"), more than 200,000 digital television products have been sold to date. It is estimated that the number of DTV products sold in 2000 will more than triple the number sold in 1999.

Retailers report that consumers are enthusiastic about the improved video and audio quality that DTV delivers and we find that consumer satisfaction is high among the early adopters purchasing digital receivers. CBS is already broadcasting 12 prime-time hours a week in high definition, while ABC, Fox, NBC and PBS all are offering digital television programming. Cable and direct broadcast satellite program providers such as HBO and Showtime also are initiating new digital programming, including high definition. Consumer excitement is certain to build as more DTV programming becomes available.

Moreover, the rollout of digital products and programming is expected to accelerate dramatically as a result of cable compatibility agreements between CEA and the National Cable Television Association. Technical standards for the direct connection of DTV receivers to digital cable systems will clear the way for commercially available, cable-compatible DTV sets, thereby removing a critical impediment to consumers' embrace of digital technology.

⁶ NPRM at ¶ 5.

As these facts indicate, the DTV transition is well underway and the momentum is growing. Zenith is concerned, however, that the current lack of sufficient amounts of high-definition programming will hinder the rapid rollout of digital television. CEA's analysis of the potential growth of DTV receiver sales, assuming various levels of HDTV programming content, underscores the need for broadcasters to step up their programming efforts to help spur receiver sales.⁷

IV. THE 8-VSB TRANSMISSION STANDARD IS MEETING THE PERFORMANCE GOALS FOR WHICH IT WAS SELECTED

The FCC adopted the industry-recommended 8-VSB transmission standard after an extraordinarily open, scientifically rigorous and painstakingly scrutinized peer-reviewed process that took an entire decade to complete. The 8-VSB system was chosen following years of extensive laboratory and field testing of various competing systems. The analysis included studies of the relative merits of 8-VSB and COFDM. The FCC's exhaustive record on digital television fully documents both the industry's (through the ACATS and the ATSC) and the Commission's unanimous conclusions to adopt the 8-VSB standard because of its superior ability to allow digital stations to

⁷ According to CEA, if broadcasters choose the "fast lane" to DTV and demonstrate 100 percent compliance with the FCC's rollout schedule while providing a high percentage of digitally-originated content to consumers, DTV product penetration could reach 50 percent by 2006. If broadcasters take a "middle of the road" approach and experience continued station conversion delays while providing consumers with a high percentage of up-converted analog content, DTV product penetration will be no more than 30 percent by 2006. Finally, if broadcasters choose the "off ramp" on the road to DTV – characterized by non-HDTV business models and delays related to reopening the DTV standard – DTV product penetration will only be 15 percent by 2006.

replicate the service areas of their paired NTSC stations, thereby delivering digital television service to the largest number of viewers.

Since the beginning of the DTV movement, the top priority of the FCC (and broadcasters) has been insuring that a DTV station's service area is generally equal to or better than its NTSC service area, thereby allowing digital broadcasting to reach the maximum number of viewers possible. Accordingly, the 8-VSB system was selected in large part due to its superior signal coverage as compared to COFDM. Indeed, use of COFDM would result in a significant loss of suburban and rural viewers who live on the fringe of a station's NTSC service area, far surpassing the comparatively fewer number of viewers in dense urban areas who might be affected by multipath interference.

The 8-VSB system allows broadcasters to replicate their entire NTSC coverage area from a single transmitter site at three-and-a-half times less power than COFDM requires. Increasing COFDM's transmitting power to obtain coverage comparable to that provided by 8-VSB (in order to match existing NTSC service areas) would result in increased interference to the existing NTSC services and other DTV services, and would force broadcasters to incur significantly higher costs for more powerful transmitters and additional electric power.⁸

In addition to offering broadcasters a greater coverage area, superior interference protection for existing NTSC and new DTV services, and lower costs, the 8-VSB system also provides greater immunity to impulse noise interference (which is

⁸ See DTV Report on COFDM and 8-VSB Performance, FCC/OET 99-2 (dated Sept. 30, 1999) (the "OET Report").

essential for VHF transmissions). The 8-VSB system also delivers a higher bit-rate capacity than COFDM, an advantage that is important not only for HDTV transmissions but datacasting services as well.⁹

The conclusion that 8-VSB is superior for purposes of NTSC service replication is well-documented by studies conducted at literally thousands of field test sites.¹⁰ Most recently, in a well-documented scientific study, CBS conducted extensive DTV reception tests at 128 outdoor and 42 indoor sites within the coverage area of KYW-DT in Philadelphia, Pennsylvania, and concluded that “it is evident that the current ATSC system is replicating the NTSC reception coverages for both indoor and outdoor reception.”¹¹ Using second and third generation 8-VSB receivers from Zenith, Motorola and NxtWave, CBS found that these receivers could produce a perfect DTV picture 94 percent of the time using indoor antennas when even a marginal NTSC picture was available.¹² With outdoor antennas, the receivers produced a high-quality DTV picture 99 percent of the time when even a marginal analog picture was viewable.¹³ Noting that the tests demonstrated “a continuous level of improvement” in

⁹ The 8-VSB standard transmits data at a rate of 19.4 Mbps. By contrast, COFDM provides a useable data rate of 18.6 Mbps. The OET Report states that the 8-VSB system’s data rate advantage over COFDM could impact the ability of broadcasters to provide HDTV programming. OET Report at page 27.

¹⁰ See OET Report at page 14.

¹¹ KYW-DT DTV Field Test Report, Walter Sidas, P.E., CBS Engineering, March 28, 2000.

¹² Id.

¹³ Id.

VSB receiver technology, the CBS study concludes that “8-VSB remains a viable system for providing DTV service and replication of the broadcasters’ service area.”¹⁴

Finally, while it is clear that 8-VSB meets the ultimate performance goals for which it was designed and selected – NTSC service replication, maximum data rate, interference rejection, etc. – Zenith notes that VSB technology has the flexibility and headroom for future enhancements, compatible with the FCC’s standard. Recently, some in the broadcast industry have focused attention on the potential portable and mobile applications of DTV technology. If broadcasters and consumers desire such options in the future – options that were not contemplated when the ATSC DTV Standard was developed and adopted – there are opportunities to augment VSB transmissions by employing a mixed data mode of two or more simultaneous transmissions of varying data rates and robustness.¹⁵ Any such extensions to the standard, however, should be pursued in parallel with ongoing 8-VSB receiver improvements so as not to hinder the transition to free over-the-air digital television. Altering the ATSC DTV transmission standard by any other means than in a backward-compatible fashion would seriously disrupt the DTV transition, as discussed in Section VI below, to the detriment of the public.

¹⁴ Id.

¹⁵ Zenith’s original VSB developments included a rugged data mode for lower data rate transmissions; however, broadcasters indicated that an increased coverage area and a higher bit rate were of the utmost importance.

V. SIGNIFICANT PROGRESS IS BEING MADE TO IMPROVE INDOOR RECEPTION

As the Commission correctly recognized in its unanimous dismissal of the Sinclair petition, all of the indoor reception problems noted to date are the result of a shortcoming in the first generation of digital receivers, not a flaw in the 8-VSB standard.¹⁶ Since the introduction of the first generation of receivers, Zenith and other manufacturers have aggressively taken steps to improve indoor reception. Zenith recently demonstrated its third- and fourth- generation demodulator chips which show dramatic improvement in multipath performance for VSB receivers. See Appendix A.

It is important to note that it took decades for improved NTSC receiver designs to be refined and perfected, whereas DTV receiver refinements are being accomplished in just a few short years. Indeed, Zenith is confident that new generations of chips and receivers will continue to improve indoor reception, and other manufacturers of DTV receivers and chips are making similar progress. A chart detailing the evolution of 8-VSB receiver performance is attached as Appendix B. As the chart illustrates, significant enhancements have been made in each new generation of receivers.

As the Commission is well aware, however, receiver improvements are only part of the solution. Broadcasters need to do their part to address reception problems as well. Reception is affected adversely when broadcasters transmit signals at less than their full authorized power, from antennas that are less than their full authorized

¹⁶ The Sinclair Letter notes the OET Report which concludes that multipath reception problems identified in early DTV receiver designs are solvable with improved adaptive equalizer performance and that a well-designed 8-VSB receiver should be able to provide satisfactory reception where strong multipath conditions exist. OET Report at page 24.

height, or with incorrect technical parameters (which can cause “jitter” and other problems).

VI. CHANGE IN TRANSMISSION STANDARD WOULD SIGNIFICANTLY DISRUPT AND DELAY THE DIGITAL TRANSITION

In the Fourth Report and Order, the Commission stated that a single transmission standard would ensure that all affected parties, *i.e.*, broadcasters, equipment manufacturers and the public, have sufficient confidence and certainty to promote the introduction of DTV service.¹⁷ The ATSC DTV Standard has been in place for more than three years now and the transition to DTV is well underway. We agree with the Commission that any attempt to change the DTV transmission standard now would result in a multi-year effort, requiring, among other things, the development of a complete COFDM standard, the achievement of an industry consensus on that standard, and extensive laboratory and field testing.¹⁸ Moreover, as the Commission points out in the Sinclair Letter, allowing more than one standard could result in compatibility problems that could cause consumers and licensees to postpone purchasing DTV equipment, thereby leading to significant delay in the implementation and provision of DTV services to the public.¹⁹

¹⁷ Fourth Report and Order, 11 FCC Rcd at 17787-17791 (1996).

¹⁸ See Sinclair Letter.

¹⁹ In addition, according to Nat Ostroff, Vice President of Sinclair Broadcasting Group, multiple standards “would not only create chaos but would so fragment the market so that no serious business could invest in the tooling to produce multiple standard receivers into such a market.” Nat Ostroff, Vice President, Sinclair Broadcasting Group and Chairman, ALTV Engineering Committee, A White Paper: Facing the Final “Sign Off,” Why We Need a Digital Standard (visited October 8, 1999)

Including COFDM in the transmission standard would require the development of a severely modified spectrum use plan, system design and extensive research and testing (both by all affected industries and the Commission) to determine COFDM's interference characteristics and allowable transmission powers. And, as the OET Report states, further study would also be needed to examine whether COFDM could support satisfactory service on VHF and lower UHF channels due to impulse noise concerns.²⁰ Moreover, COFDM's power requirements for equal coverage and associated interference problems would most certainly require that the DTV Table of Allotments be re-analyzed and revised, a formidable task considering the long and arduous process that the Commission went through to finalize the current DTV Table.²¹

Considering a change in the standard also threatens to freeze the development and deployment of DTV technology by causing uncertainty to manufacturers who must invest millions of dollars in product development, and who must be confident that they are designing to a standard which will guarantee a national purchasing base. Any manufacturer, chip designer or information provider that continued to produce digital television products while a new, non-compatible standard was being considered would do so only at considerable risk.

(formerly available at <<http://www.transmitter.com/DTV/NatOstroff.html>>).

²⁰ OET Report at page 24.

²¹ In adopting the 8-VSB standard, the Commission noted that "more than one transmission standard would make it more difficult to facilitate an efficient allotment of broadcast channels and protect against interference." Fourth Report and Order, 11 FCC Rcd at 17788.

Indeed, it is evident that the mere possibility of a change in the standard already is causing some broadcasters to postpone purchasing DTV equipment for fear that such equipment would be incompatible. Moreover, if the standard were to change, existing DTV transmitters and receivers would need to be modified or could become obsolete.

The confusion fostered by a potential change in the transmission standard doubtless is causing consumers to postpone their decisions to purchase DTV receivers, as the Commission noted in the Fourth Report and Order, because they do not want to take the risk of investing in what might soon be an obsolete technology, or because they believe different technologies could soon be available.²² Moreover, a change in the standard would harm those consumers who already have purchased equipment with the expectation that their DTV have the capability to receive all of their existing over-the-air channels; be transportable to other broadcast markets without diminished or complete loss of functionality; and receive over-the-air broadcasts for many years to come.

The lengthy delay inherent in a change of the DTV transmission standard would do much more than forestall the introduction of new innovations and services to the public. It would be incompatible with a key consideration of Congress in its decision to award additional spectrum to broadcasters – namely, the ability to auction spectrum recovered at the end of the DTV transition. Although the spectrum will not be recovered until broadcasters vacate the spectrum at the end of the transition, Congress has mandated that auctions for that spectrum commence this year so that the money

²² Fourth Report and Order, 11 FCC Rcd at 17788.

raised can quickly be deposited in the nation's treasury. If the end date of the transition is extended, it could detrimentally impact the Federal budget by lowering the value of the spectrum to be auctioned, as bidders face extreme uncertainty as to when they may be able to utilize the spectrum for their own purposes.

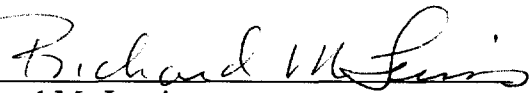
In short, a change in the DTV transmission standard would cause years of delay without any countervailing benefits. The Commission should continue to exercise effective leadership to ensure that the digital conversion's momentum continues to grow. Confirmation of the 8-VSB transmission standard would provide the certainty necessary to fuel continued investment at all levels of the DTV marketplace and ensure the successful launch of this exciting and important technology.

CONCLUSION

The 8-VSB standard is achieving the goal of NTSC service replication – the DTV transition's top priority – and DTV receivers are showing significant improvements in their ability to handle multipath interference under the standard. Accordingly, there is no reason to reconsider the transmission standard. To do otherwise would only needlessly disrupt the transition and delay the availability of digital television to American viewers.

Respectfully submitted,

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May 17, 2000

APPENDIX A



FOR IMMEDIATE RELEASE

THIRD GENERATION CHIP ENHANCES INDOOR DTV RECEPTION

LAS VEGAS, April 8, 2000 – In a technological breakthrough that continues to address indoor reception issues related to digital television (DTV) signals, Zenith Electronics Corporation and LGE today introduced a third-generation demodulator chip that will improve multipath performance for VSB receivers.

Demonstrated this week in booth L2604 at the National Association of Broadcasters convention, the new VSB chip addresses static and dynamic multipath interference with a wider equalization range and faster synchronization recovery.

It cancels ghosts of length 40 microseconds and because of the faster synchronization and equalization, the chip enables cancellation of faster dynamic ghosts that result from both vehicular and people movement in the case of indoor reception.

Dozens of LGE engineers have been working on this multimillion-dollar chip development project in the past year. The biggest improvements over previous generations include the longer equalization and fast sync recovery using faster algorithms. Chip samples and evaluation boards will be available in May.

Founded in 1918, Zenith Electronics Corporation, based in Glenview, Ill., is a long-time U.S. leader in electronic entertainment products and leading developer of digital high-definition television (HDTV) technologies. Zenith is a wholly owned subsidiary of LGE, a global leader in consumer electronics with operations in 180 countries and annual sales of more than \$9 billion.

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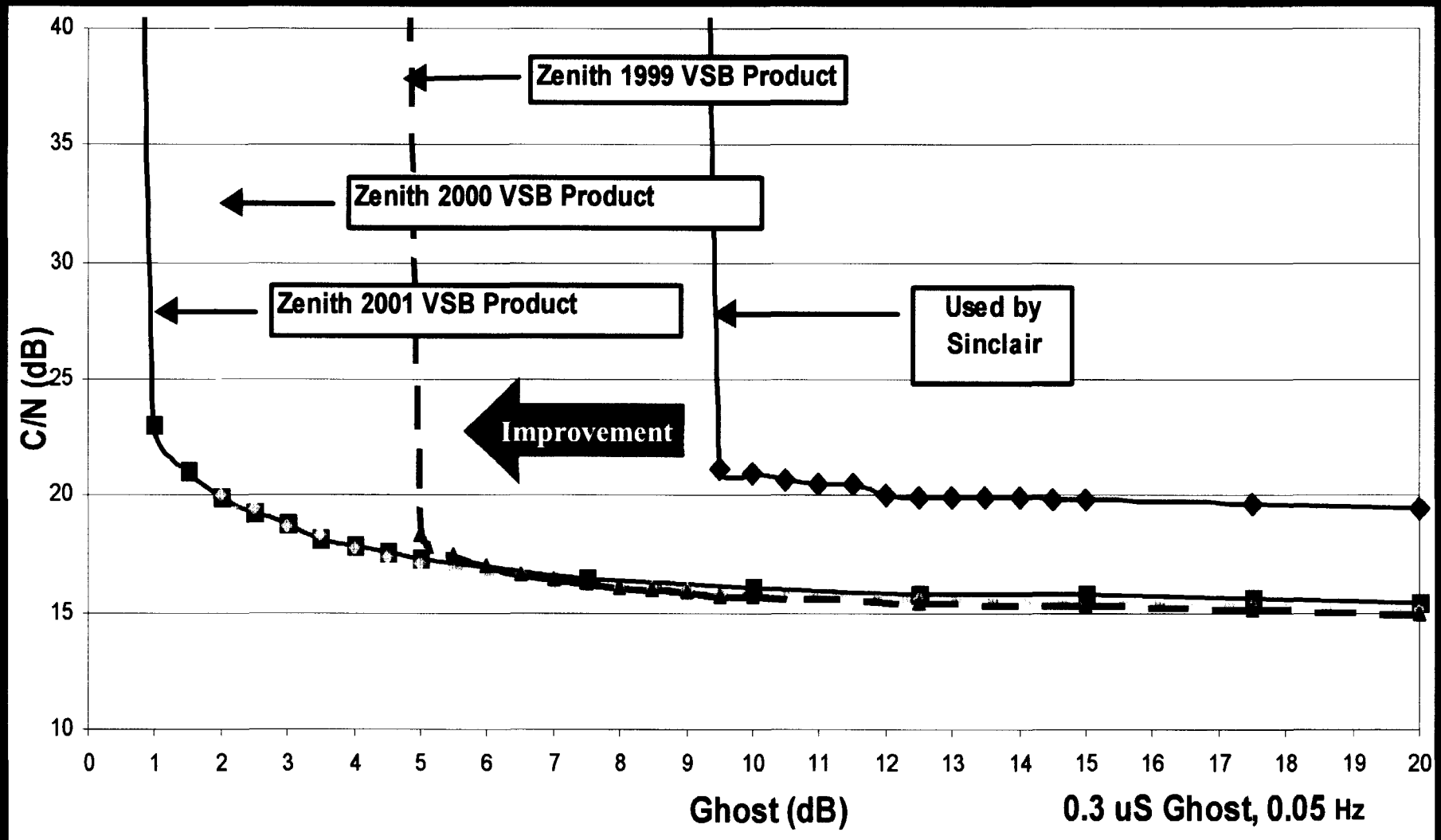
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Operational Threshold vs. Ghost Level

Improvements



APPENDIX B

Receiver Performance Evolution

